Journal of the American Foundrymen's Association.

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ACID PROOF AND REFRACTORY VARIETIES OF CAST IRON.

Eisenzeitung, Nos. 1 and 2. The German Metallurgical Engineer, Carl Rott, writes on a subject which has troubled many of our manufacturers of this country also. In the evolution of foundry mixtures intended to produce iron which would be acid proof, as well as castings which could resist the application of heat to the greatest degree possible, the controlling idea has been the elimination of the ingredients which tend to reduce the resisting power of the materials to heat or chemical action, as the case might be. Thus for acid proof castings it is essential to have irons as low in sulphur and phosphorus as possible; then also the carbon should be in the combined form to as great an extent as may be safely allowed. Mineral and vegetable acids affect irons readily which have high sulphur and graphite contents. Silicon and manganese do not seem to be affected as much. Here is the composition of good irons of this kind: Silicon 0.8 to 2.0; phosphorus 0.4-0.6; sulphur .02-.03; manganese 1.0-2.0, and total carbon 3.0.3.5 per cent. Makers of pumps for mining purposes or where there is acidulated water coming from factories would do well to make a note of this. It is important to have clean coke, furnace iron would be better, as it is freer from oxidation. Where the castings are not to be machined the fracture may be mottled to nearly white; where machining is done the grain should be as close and fine as may be allowable. To help a little in the latter case an annealing of 24 hours can be used with advantage. Now as to the refractory castings. This, Mr. Rott thinks, is not so difficult a problem. A low

sulphur contents is essential; phosphorus may be normal and manganese low. It is well to have low silicon and carbon. Scrap steel is therefore a good admixture. Here is a typical annalysis: Silicon 1.8; phosphorus 0.7; sulphur .03; manganese 0.6, and total carbon 2.9 per cent. Melt hot and vent the molds well. Mr. Rott concludes his article by warning German foundrymen from adopting so-called American processes, as they are sure to find upon trial under the different conditions existing in the Fatherland. The few processes he describes turn out to be the ones we have branded as frauds over here ourselves.

FOUNDRY IRON AND MELTING METHODS.

Stahl und Eisen, Jan. 1st. In an address under above title, and delivered before the Iron and Steel Association of Upper Silesia, General Manager Grau gives a very interesting picture of the foundry industry of Germany. After discussing the methods used for the production of foundry irons at the furnace he takes up the foundry. He claims that all German foundry irons are good, which is news to us here who have been led to believe quite the contrary. He explains this, however, by stating that the high phosphorus ores are all bought up for steel making, which leaves only the purer ones for the foundry. Fortunate German foundrymen! We Americans would be apt to discount any such optimistic views when coming from a blast furnace owner. In discussing cupolas it is held that nearly all the intended improvements are in the direction of saving coke. This circumstance Mr. Grau says should make us careful to observe whether the saving of the coke is not counterbalanced by an equivalent oxidation of the metal in the removal of parts of its silicon and manganese. The result he thinks would be excessively hard iron. The proper way to economize coke is in preheating the blast by the hot gases passing out of the cupola. We are warned, however, to look out for the oxidizing effect of a warm blast. Mr. Grau also advises that the tuyeres be kept above the bottom as much as possible to avoid a direct blast of air on the melted bath. An alternative would be the addition of the forehearth. This forehearth, however, the lecturer condemned on account of the tendency to chill the iron and, as he claims, the promotion of an ununiform mixture. The advice given would then seem to lean toward the retention of large

bodies of melted metal in the cupola—in other words the Bessemer Works Cupola process, a process which is found undesirable for foundry work here, preferring as we do to tap often and fill bull ladles to get good mixtures, plenty of coke being used to get good hot iron. In one respect, however, Mr. Grau is correct, and that is the mistake in leaving the cupola tender or foundry foreman do the mixing. Once these gentlemen hit upon a mixture making nice smooth castings it is used indiscriminately for all purposes, whether the castings are heavy or small. The constitution of the irons used is not known nor the mistakes in grading which may have been made noted. Fortunately in our country this is passing away, and many are the foremen who can sit down and figure out good mixtures for given purposes and know just what they are doing. Another point of interest is brought out by Mr. Grau when he states that all parts of the mixture do not melt equally fast in the cupola and hence the irons poorer in phosphorus should be broken up into smaller pieces. Finally stirring up the ladle before pouring large castings is recommended in order to get a uniformly mixed iron. Mr. Grau now turns to the political side of the foundry question and explains why American agricultural machinery is exported to Germany in such enormous quantities. He says that this machinery is unquestionably superior in quality to theirs and this is only due to the enormous production of the individual exporting foundries of America. The sharp inspection before shipping, the organization of the founders for this work and the selection of men who are educated for their work make this excellence of product possible, and the commentary is that Germany should do likewise. Mr. Grau advocates a sort of foundry trust with headquarters to receive all orders, which are to be distributed to their works best able to produce the desired castings. Standardization of agricultural castings as well as strengtn of the iron in them should be sought for. American foundry practice is held up as an example in this respect which should be followed.

IMPROVEMENTS IN CUPOLAS.

The Foundry, February. Dr. Edward Kirk reviews the history of cupola construction, beginning with the early stationary bottom draw front apparatus, built upon a stone foundation three or four feet high or else upon a hollow foundation with a cast iron plate to

top it. The casings were made of cast iron, the lining was arched over the front and the opening closed with an iron apron fastened to the casings and lined temporarily with loam to keep it from burning out. A small opening in the apron served as a tap hole. This peculiar style of old fashioned cupola is described at length by Dr. Kirk and may still be seen in a Baltimore foundry, where they have held their own sinee 1813. The difficulty with this style of cupola is to get out the refuse, slag, etc., after the heat was finished. The moment the cold air entered everything chilled and had to be sledged off. The drop bottom was a great improvement. It was supposed to come from New England, and is said to be an American invention. It was introduced about fifty years ago and took a long time to become generally adopted. In olden days the stacks of the cupolas were made larger than the crucible, the casings consisted of cast iron stacks held in place by wrought iron bands, and eight feet was considered a high cupola. Blast was admitted through two tuyeres opposite each other and the melting was necessarily slow. The various improvements in the location and shape of tuyeres are now enumerated, and Mr. Mckenzie's radical departure in this line explained. This was the ten hour cupola. His idea was to abandon the driving of blast to the centre in the shape of two small jets of air, and substitute therefor a wind box with a lot of tuyere openings which gave quantity of air rather than intensity. Next came the Lawrence, Pevie and Dougherty cupolas, all of them having special merits over the old and each other. Colliau's plain round cupola followed all the above in 1874 and from all possible shapes cupola design got back to the style of 40 years ago. After numerous changes the modern cupola is back to the old form, but much improved in its details and general adaptations to modern requirements. Dr. Kirk advises foundrymen to buy the cupolas now made by regular manufacturers rather than to construct them at the place.

THE FOUNDRIES OF THE U. S. AND CANADA.

The Foundry, February. The foundry trade is greatly indebted to "The Foundry" for its work in compiling accurate lists of all the foundries in this country. On January 1, 1902, there were 4,615 of them. The capacity is fully thirty per cent. above what it was two years ago. Such has been the remarkable activity of

this industry of late. Pennsylvania, New York, Ohio, Illinois and Michigan contain 2,269 foundries, or nearly one-half of the trade. New York has most of the brass foundries, Pennsylvania being first in those of iron. There are now 107 "malleable" foundries, Illinois leading the rest with 18, Pennsylvania coming next with 16. The capacity of the old plants has been largely increased. In steel casting plants Pennsylvania leads with 29 establishments, or 40% of the total number. Chicago still maintains the leadership of the world in having the greatest number of foundries within its confines, though Philadelphia has the greatest variety of them, Pittsburg coming third. The article concludes with a list of foundry consolidations recently consummated.

FOUNDRY DEVELOPMENT IN THE PAST TWO YEARS.

The Iron Trade Review, January 16. In an editorial on the above subject attention is called to the remarkable growth of the foundry industry in this country. Existing plants have been enlarged and new ones built by the score. The cause of all this is the enormous home demands for castings going into machinery of all kinds. Not only the regular jobbing foundries have been running very full, but light gray casting, malleables and steel have been in requisition in unheard of quantities. "Penton's List," the acknowledged authority on the statistical side of the subject, summarizes the iron foundries existing at the present day in the United States at 4,615, a gain of 470 in two years. Add to this 875 brass foundries, and we have a total of 5,490 foundries of all kinds. There are now 107 malleable foundries, 72 steel foundries, and 269 stove foundries. Canada has 501 iron and 26 brass foundries, which shows a looking up of the trade in that country. The principal hold of the trade is in the States touching the great lakes. The outlook for continued prosperity is good and a year of extensive operations is predicted.

CAR WHEELS, THE ALLEGED DECADENCE OF.

The Iron Trade Rewiew, January 2. Mr. William Fawcett discusses the reported dissatisfaction with the cast iron car wheel when used in very heavy freight service. It seems that the officials of some of the large railroads think that car wheel makers could do much better than they are, and thus produce wheels with

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greater life under the heavy cars put out at present. It is further claimed that our wheels are gradually degenerating year after year, and the once magnificent specimen of iron is replaced by one comparing very unfavorably with former days. Car wheel makers claim that they are getting too little money to turn out the best grade material. They sell wheels at $22.00 a ton and must take back an equal weight of scrap at $17.00. It is an injustic to expect the makers of good wheels to take back and use scrap coming from everybody. Again Mr. Fawcett holds that to get the best results only a limited proportion of scrap should be used, and melted with the highest grades of irons low in phosphorus and sulphur. In fact the phosphorus contents should not be allowed to run over 0.325 in any wheel, and similarly sulphur not over 0.07. An originally good wheel when remelted increases in sulphur, and as this remelting proceeds ad infinitum, with intervals of 5 to 7 years, the iron must naturally become more and more charged with sulphur, and hence be poorer in good qualities. A plea is finally made for relief from onerous specifications.

THE CONDITION OF SILICON IN CAST IRON.

Stahl und Eisen, February 15. Mons. P. Lebeau discusses this question in the "Comptes rendus." He claims that the theories advanced by previous investigators are faulty, and gives a number of experiments to prove that all the silicon present in cast iron and low silicon ferrosilicon is there as SiFe 2. First of all he got some silicon powder and treated it with nitric acid and also with the double chlorides of copper and potassium. It was not affected though remaining for 12 hours in contact with each of these reagents. On the other hand cast iron treated thus gave a residue in which no pure silicon could be found. There is no question therefore but that all the silicon present is in combination, and this was afterwards proved to be a silicon iron compound. To test the permanency of this compound SiFe2 it was melted with silver, in which it dissolved After cooling the alloy it was dissolved in nitric acid and the residue again gave the silicon iron compound. The solution contained no trace of iron or silicon. The alloy of silver and silicon-iron was placed in the electric furnace and the silver volatilized at the melting point of cast iron. Crystals of silicon-iron were left behind again. This is all additional proof that the same compound is the

one existing in cast iron. Mr. Lebeau concludes that this compound is dissolved in the excess of iron present in cast iron and the whole material upon setting becomes a homogeneous mass so far as the silison is concerned.

METALLOGRAPHY IN CAR WHEEL MANUFACTURE.

The Iron Age, February 20. Mr. A. W. Whitney discusses the recent articles which have appeared on the car wheel, its decadence, merits, etc. He objects to Mr. Fawcett's sulphur and phosphorus limits, claiming that good wheels can be made with sulphur as high as 0.10 and phosphorus 0.40, while neither low phosphorus nor the steel percentage in the wheel is a safe criterion of the quality of the product. Mr. Whitney also holds that Mr. Slocum's dictum that no satisfactory wheel can be produced without using at least some old wheels is beside the mark, and gives instances where he made car wheels of only pig iron which were perfectly satisfactory. A more careful study of the structure is required, and this is connection with the chemical constitution should give wheel makers ideas for the betterment of the material. Mr. Whitney holds therefore that microscopical examinations should be made of the metal in order to study its peculiarities. Six illustrations are given which show hard and other cast irons when photographed under the microscope. It is safe to add that much more must be done in the metallography of cast iron before it can be made available to the founder as an additional method of study in his taade.

THE INFLUENCE OF PROPER CUPOLA PRACTICE ON THE COMPOSITION OF CASTINGS.

The Foundry, August. Mr. F. W. Stickle discusses this question from a practical standpoint. The contact of the iron with the fuel, the amount of air used, and other conditions are so influential that the same mixture produces altogether different kinds of castings on different occasions. This Mr. Stickle discovered before he knew anything about the chemistry of the foundry. He thinks that it is necessary to hold the cupola up to the proper lines determined by experiment, and to run it carefully in order to get castings of proper composition and physical qualities from proper mixtures.

PHOSPHOR BRONZE FOR HYDRAULIC CASTINGS.

The Brass Founder and Finisher, July 15. Mr. E. S. Sperry writes on the above subject in the "Aluminum World," to remove

some of the misconceptions in regard to the making of castings to resist high pressure, so far as metals other than iron are concerned. It is a patent fact that no matter what mixtures are used the castings must be sound, for sweating through the pores of the metal must necessarily cause its rejection. The imperfections of sand castings consist of the existence of oxide and foreign matter, blow holes, shrinkage cracks and crystallization. Oxidation is perhaps most prominently seen in the aluminum alloys and hence this metal is avoided for the work under discussion. This trouble of dross being to some extent a mechanical one, suitable skim gates, gating from the bottom, and the addition of special risers will be found a great help. The best solution of the oxidation problem is the use of alloys which do not form injurious oxides when melted, and these are the phosphor-bronzes. The crystallization in a casting which produces spongy places when the metal has cooled are found most frequently in the alloys of copper with zinc, and copper, zinc and tin. Copper and tin alone makes an alloy fairly free from this trouble. Zinc is therefore to be avoided for pressure castings. Casting at a low temperature or in chills is to be recommended. Blow holes come from overheating the metal or letting it stand exposed to fire too long. The solution for trouble is obvious. Shrinkage cracks may be caused by too hard sand ramming, unyielding cores and imperpectly designed patterns. It is taught us by experience that phosphor-bronze makes the best all around metal for hydraulic work. The addition of phosphorus effects a removal of the film of oxide forming on the surface of the metal as well as that dissolved in it. The amount of phosphorus used where the alloy contains 10 to 12 per cent. of tin and risers are remelted should be about 0.25 per cent. With new metal 0.10 per cent. is sufficient for all purposes. When the tin goes above 12 per cent. reduce the percentage of phosphorus. Here is a new formula: For a tough alloy, copper 90 per cent.; tin 19.75 per cent.; phosphorus 0.15 per cent., or copper 9lb.; tin ½lb.; 5 per cent. phosphor-tin ½lb. For a hard alloy, copper 87.50 per cent.; tin 12.25 per cent.; phosphorus 0.25 per cent., or copper 8¾lb.; tin ¾ lb.; 5 per cent. phosphor-tin ½ lb. Keep lead and zinc out of the mixture. If the casting of phosphor-bronze leaks under pressure, dry it out and soak it while hot in melted parafine. This may close it up.

POURING TEMPERATURE.

The Foundry, September. Mr. F. W. Stickle holds that the chemical composition of the mixture, the design of the casting, the management of the cupola, and the method of molding have much to do with the proper pouring temperature to be selected. The gating is also important. In general a casting which is to be finished is to be poured hot, as if poured too cold the difficulties coming from segregation may make the castings worthless. Mr. Stickle claims the iron coming from the cupola dull is in a different condition from hot iron which has cooled down in the ladle. Silicon and manganese, in general, should not be necessarily high, as strength is thus sacrificed.

THE DAY'S WORK.

The Iron Trade Review, June 12. Mr. P. D. Wanner, in a paper read before the Philadelphia Foundrymen's Association, discusses this vexatious question. It seems that by general consent 10 hours is considered a fair working day for store, shop, farm and mine, but of late labor agitations are trying to make an 8 hour day and are using political weapons to enforce this. A bill has passed the House on May 20, 1902, requiring a clause in each contract to which the United States, the territories and the District of Columbia are a party, stipulating that the 8 hour day shall rule, and a forfeit of five dollars be imposed for each day per man working over this number of hours. It this bill passes the Senate, the President will sign it and then it remains to test its constitutionality. In the meantime it will work much worry on the Government authorities, and be an injustice to all men not fortunate enough to get Government jobs. Mr. Wanner holds that a nine hour day is a much better one than either the 10 or 8, and gives better scope for effective work. The average man is by nature lazy, and works only as much as he has to to support life. To accumulate wealth as a nation; it must work, and every hour more of work daily, so much more wealth is produced. The highest wages are paid only where there is the most surplus product of labor. Relieve this and you reduce the wages. The wealth producers are those who by their labor and intelligence with the use of so-called capital, call forth the various industrial enterprises. The lower strata bear the

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upper, and have the privilege of going upward, but not all succeed. Mr. Wanner closes with a strong plea for the 9 hour day. Mr. Sterling, in discussing Mr. Wanner's paper, gave an instance in his own works where it had paid to give a 9 hour day voluntarily in order to secure the proper kind of help.

THE FIRST FOUNDRY IN AMERICA.

From the daily press we hear that the Leonard family are to erect a memorial monument at Taunton, Msss , in honor of the first foundry built in America. It is to cost about $200,000. Mr. Lewis A. Leonard writes the "*American Machinist*," "It is claimed for the Leonards that they were the first successful iron master of America. For eight or ten years previous to the building of the bloomery in Taunton a casting was made here and there. They had to do with many of these efforts. But that the iron business was put on a successful commercial basis at Taunton, Mass., by the two men whose memory it is proposed to honor is freely admitted by all who have carefully examined the earlier records of this industry."

In the issue of October 2nd we find further :

"At the Old Home Week exercises held this Summer at Carver, Mass., an interesting paper relating to the early history of the town was read, in which it was shown that, as far as is now known, the first actual casting of iron in America was done there, the article produced being a teakettle. The first furnace was in operation in 1735, and a second one was built in 1760, the latter date being that of the historic teakettle. The successor of this second furnace is still in operation, under the firm name of the Ellis Foundry Company. Carver seems to have been the first home of a now prominent foundry. The Federal Furnace was established in 1793 and survived until 1841, when it was burned, the proprietors being Bowers & Pratt, who then moved to Boston and established the Highland Foundry at Roxbury. Another Pratt established a furnace at Wenhem, Mass., the same year, and his son later opened the Watertown foundry, now so well known as that of Walker & Pratt. The paper above referred to had to do with genealogies rather than with foundry history, so that its account is not as full and clear as from our view point could be wished.

THE FOUNDRY.

The Tradesman, August 1. This is the title of an interesting address delivered before the Patternmakers' Union, of Cincinnati, by Mr. Jhmes W. Gibney. The discourse was more on general lines, well familiar to our foundrymen, but valuable just the same. Toward the close of the address, however, there is some excellent advice given the patternmaker, his apprentice being counseled to spend as much time in the foundry as possible in order to get the proper conception of the molder's necessities. A perfect pattern for the foundry cannot be made by learning how to do it at a distance. Speaking of coreprints in the drag of a mold, Mr. Gibney asks why they are made with straight sides when a good taper will answer so much better. Where cores do not cut through, the molder and coremaker are kept guessing what to do. It would therefore be good practice for the patternmaker to outline these cores on the pattern. Mr. Gibney says further "fillets and round corners are always perferable to square corners for obvious reasons. Light lumber and poor bracing should be eschewed in large patterns. Such a pattern won't last. Rapping plates should be secured and placed so that they will withstand the sledge and not tear out and loosen after the rapping bar has been used a few times. A good varnish should always be used, and all dove-tails and dowel-pins made to work easy.

"The same abvice applies to core boxes. They should be substantially built so as to preserve their shape. For large cores, 'knock down' core boxes are perferable to solid ones. It is absurb to see a coremaker under the necessity of rapping a box to free it from the core and then have to patch up and finish the square edges of the core, when all trouble could be avoided by the use of a box that is constructed so that it can be taken apart. Blocking does not materially increase the size of a core, and if properly made and no sagging or distortion takes place, the dried core should be exactly as it leaves the core box; there is no expansion of a core in drying.

The question of shrinkage is one which must be carefully considered by all patternmakers. One-eighth inch to the foot was at one time the standard, but more recent investigations demonstrates that irons vary in shrinkage, so that it cannot always be controlled to a fraction of an inch. General practice now, however, favors

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an allowance of about one-tenth inch to the foot. No better advice can be given either to patternmaker or molder than to study closely the characteristics of the metal in which they are both so deeply interested. Its peculiarities must be known to be provided against or taken advantage of, and without an intimate knowledge of them neither patternmaker nor molder can do their best work.

CASTING PIPE.

Eisenzeitung, No. 33 and 34. It seems that in Germany government and town officials are beginning to specify their gas and water mains cast flanged portion downward instead of this end up as is usually done. A number of illustrations are given showing the defects of pipe flanges when forming the upper end of the mold. Not only do we find sponginess, blow holes and shrinkage spots, but there are differences in the diameter of the flanged portion as well as casting strains which make a sound lead joint a problematical one. It is claimed that by casting the pipe flange downward all these difficulties are obviated and that material advantages result from a proper equipment for this method of casting. It is claimed that the cores and molds themselves can be dried cheaper and better when thus arranged, that a better looking casting is the result, and that the dimensions are kept better. The castings are furthermore sound and better able to resist hydraulic pressure, and the loss is much lighter. Again the sinking head is only one-third the weight, with the advantage this means. It is further claimed that cheaper irons, that is, irons lower in silicon, can be used to advantage with excellent results.

WHY CHILL ROLLS BREAK.

Tin & Terne, March 20th. *Fer Blanc* gives some information on the subject. As a rule when the roll breaks it is a commercial question rather than one of finding out why it happened. The mill superintendent wants a rebate from the foundry, and the foundryman decides for himself whether it is good policy to submit to the terms demanded. A good chill roll should possess three characteristics. A high tensile strength with no weak places. It should have casting strains, and the coefficient of expansion of every part of the roll should be as nearly identical as possible. Were these ideal conditions attainable to the fullest extent, only

extremely bad mill practice would destroy the roll. In general the selection of good irons gives a high tensile strength. Good proportion of the sinking head, with the possibility of keeping this fluid for the maximum time will do much to eliminate the weak spots. It is an impossibility to cast a roll without internal strains, the chilled portion sets at once and the rest cools more gradually. When the whole casting has set the temperature becomes more evenly distributed, and the roll gradually cools. It is necessary to see that the roll does not become elliptical through unequal cooling. Regarding the question of the coefficient of expansion of the roll, it will be known that the chilled portion of the roll expands differently from the gray interior. Now it can readily happen that the roll may be so overheated that rupture in the outer particles takes place from this cause. The consequence is that a chance is given for surface cracks to run inward and eventually break the roll. *Fer Blanc* concludes with some interesting suggestions relative to the method by which the internal strains of a roll may be studied. Considering the amount of money involved annually in the replacement of broken rolls and the amount of argument and trouble created, this would amply be justified.

THE SAND BLAST.

The Iron Trade Review, June 12. Mr. A. G. Warren, of Philadelpaia, Pa., discussed his sand blast system in a paper read before the Philadelphia Foundrymen's Association. The following points are of interests in this connection. The foundry has used the sand blast process for ten years already, though it is about 30 years old. The machine should be strongly built to resist rough usage of unskilled labor. Plenty of hand holes should allow obstructions to be removed easily. All parts liable to wear should be easily replaceable. A specially made hose of Para rubber lasts about 6 months or one year. Hard iron tips and nozzles give the best satisfaction. The sand should be hard and tough and not too fine, and be thoroughly dry and cool before using. Overheating destroys the grain by unnecessary breaking up. Use a good air compressor. For a brass casting use 10 lbs. pressure. For gray iron 15 to 20 lbs. For steel castings 25 lbs. per square inch should be the rule. The size of openings of the nozzles varies from ⅜" to ¾", depending upon the work in hand. The great amount of dust

produced makes it advisable to provide a seperate room for the installation and an exhaust for the removing the dust. Preparations should be made to use the sand over again. Sand blast tumbling barrels are also very economical. As a rule where well installed an equipment pays for itself in three years. It is also advantageous for galvanizing purposes.

A NEW MOLDING PROCESS FOR REPRODUCING PATTERNS.

American Machinist, August 21, describes a new molding process by which a large number of patterns can be reproduced from one original master pattern. First a permanent or master pattern is made of wood, a mold is made with it in the usual way; this is filled with melted rosin. The rosin is then used as the pattern for the duplicates of the original, the sand being packed around it, and the rosin then melted out. Metal poured in as usual will give an excellent counterpart of the original pattern. While the idea is novel, its use seems to rest only in getting a little better finished series of castings for duplicate patterns. We hope to hear more of the process.

FOUNDRY FLASKS.

The Age of Steel, page 80. Mr. P. R. Ramp gives his ideas on foundry flasks and holds that this item is one of the important ones in the expense account of every foundry, Often a large and expensive flask is made where the job should have been bedded in the floor. A good flask is always the safest and cheapest one in the long run. If an all iron one is too expensive, one with iron ends and wooden sides will do. Fig. 1 represents such a flask in use for the bed of a small ice machine. It is 6 ft. long, 3 ft. wide, and has an 8 inch cope and 20 inch nowel. The iron ends (A) are 1½ inches thick and the trunnions (B) are about 3¼" in diameter. The pins and plates (C) are much larger than is usually the custom, to prevent them from becoming loose and allowing shifting. Only two pins and plates are used, both of these placed on the same side. Fig. 2 gives a sectional view of the trunnion and iron end on a flask of this kind. It will be noticed that at the joint between the iron and the wooden timber which forms the side of the flange, the one indicated by the letter (a) in figure 2. An iron end of this kind is not as safe as when the additional flange B is used, as the

lifting is done by the trunnions and all the strain is on the bolts that hold the timber and iron ends together. When the mold is lifted these bolts have a tendency to give, and cause the end of the flask

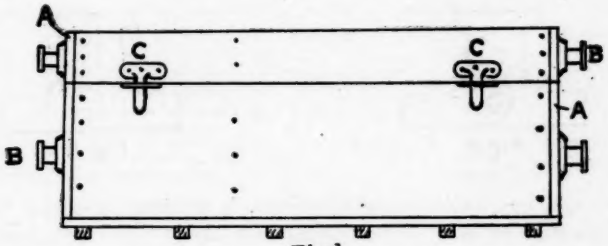


Fig.1.

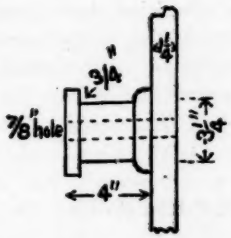
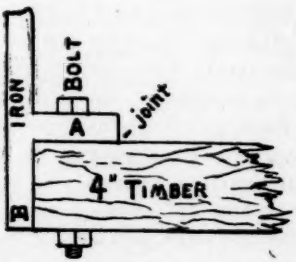


Fig.2.



to draw away from the sand, which often results in a drop out. Where, in case of the additional flange shown at letter B, the timber is butted up against the flange—which prevents the flask end from

twisting—this releases, to a certain extent, the strain on the bolts. Where it is possible, it is practical to use trunnions on a flask, as there is less strain on the mold in rolling over the drag, lifting off

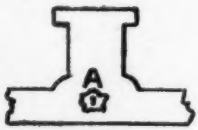


Fig 3.

Fig 4.

the cope, etc., besides, much less room is required to use a flask with trunnions, as it can be hoisted up, turned over and lowered down in the same bed. In casting a trunnion on the iron ends of a flask it is advisable to core a hole through the centre of the same. This strengthens the trunnions, as otherwise there generally is a shrink hole found in the center of the casting, at the point near the plate, which makes it weak and dangerous. What should be done is to core out the heavy body of metal that is the cause of the shrink hole, shown at (A) in Fig. 3. This would cause it to resemble Fig. 4.

FOUNDRY COST KEEPING.

The Iron Trade Review, August 7. "S. F." explains a method by which foundrymen can keep an accurate account of the cost of castings of all kinds. First the cost of pig iron and scrap is known, and the weight of the castings gives the cost of such raw material with the required percentage of shrinkage by going through the cupola. Next, a card system shows how the labor cost is ascertained by taking accurate account of the time spent per day on each piece and figured up for total cost when charging the castings for delivery from foundry. Then comes the proportionate cost of supplies and material other than iron, scrap, coal and coke. This includes light, taxes, sand, facings, etc. Fourth comes the cost of non-producers, from Superintendent down to the ordinary help not directly chargeable to molding. Some details are now given regarding the system. On the score of the iron 1 cent per lb. is usually allowed for the cost of melted iron and the fuel used, in or-

dinary times. One-quarter of the actual weight of the castings will represent the cost of the non-producers. Add to this the actual number of hours molding, at the rate paid; add cost of cores, finally 25 per cent. further cost of supplies, and the total cost is the amount spent for each casting. Thus an example is given, as follows :

Weight of casting, 9,000 lbs. @ 1 ct.	$90.00
25 per cent. for non-producers,	22.50
Molders @ 30 ct. per hour., 4.5 days,	13.50
Helpers @ 15 ct., 3 days,	4.50
Coremakers @ 25 ct., 3 days,	7.50
Cleaners @ 20 ct., 2 days,	4.00
Total for labor and iron,	$142.00
25 per cent. for supplies,	35.50
Total cost.	$177.50

or $1.97 per lb. cost. A number of fac similes of cost cards are given, to which those interested are referred. These cards are of three different colors. A white card is used for the original order, with a duplicate on a white card prepared by carbon, this duplicate remaining in the foundry, for further reference, the original card travelling to the cost clerk after the order is completed. A colored card is used for cases of partial delivery, the original card being retained until the order is completed. Another colored card is used for rejected castings. The following forms are used: No. 1, cost card, 6 " x 4 ", gives original order number, when pattern was received, with shipping directions. Then comes name of customer, date of cast, when billed, the number of castings, description, weight, total cost, and cost per lb. No. 2 is for rejected castings, 13½ " x 6 ". The name of the casting, when rejected, for what cause, the name of foreman, molder and apprentice, the weight, molder's time and helper's time, and total cost being given. No. 3 is the cupola sheet, 11 " x 8½ ". First comes the name of the mixture, the weight of coal, coke, foundry scrap, yard scrap, other scrap, six columns for pig iron, and total for metal charge. At the bottom of the columns a line is left for totals, which gives total amount of fuel and various kinds of scrap and pig iron used, for stock yard records. Below this is noted the time of lighting, blast on, first tap, bottom dropped, length of heat, condition of iron, and fuel ratio. The sheet is signed by the foreman daily before passing into the office. No. 4 is for the foundry supplies used, 12 " x 6". Five columns for different fire and molding sands, then sea coal, coke facing, fuel, brick (two columns), clay and miscel-

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laneous. No. 5 gives the monthly expense card, 6" x 4". Spaces are left for sand, metal, fuel used, the percentage of fuel to iron, the metal brought from yard, castings made, percentage shrinkage, number of castings charged up, average weight of castings, number of castings rejected, their weight, the percentage of rejected work, cost per lb. at cupola and supplies, labor cost, total cost per lb. No. 6 is the weekly expense card, 6" x 4", and gives the lbs. of sand, castings good, castings bad, percentage of rejected work, the molding cost per 100 lbs., core making, scratching, molder's helpers, furnacemen, miscellaneous help, total non-productive labor, pattern shop, total cost per 100 lbs. Finally, No. 7 gives the semi-annual report, 6" x 4". As an actual example of a prominent western foundry, this is given: Sand used 2,562,245—41 per cent.; metal melted 9,127,500; fuel used 1,389,220; the per centage being 6.5 to 1; metal brought from yard 6,409,580; castings good 6,224,187; percentage of shrinkage, or melting loss, 2.9 per cent. Number of castings charged up as good 18,542; average weight 335 lbs. Number of rejected castings 544, 129,130 lbs., equal to 2.02 per cent. Cost per lb. in cupola .00762; supplies .00079; labor cost .00748 without pattern shop. With pattern shop it cost .00859. Total cost per lb. .01696; with foundry expense .02116; with pattern shop expense .02165, or 2.165 cents per lb.

CHILLED CAST IRON CAR WHEELS.

The Iron Trade Review, April 24. In a paper read before the students of Purdue University, Mr. E. H. Vannier describes the modern method of making car wheels of cast iron. During 1901 there were about 12 million cast iron car wheels in service in this country, weighing about 3½ million tons. In progressive car wheel foundries all the pig iron is bought under chemical specification. The iron is mixed and melted in cupolas having a rate of melting of about 20 tons an hour, some of these continuously for 8 or 9 hours. Test pieces are cast from the metal as it leaves the cupola; the chill in these should be 1" to 1¼" in depth. Two men prepare the molds and pour iron for from 18 to 25 wheels for a day's work. The molds are now described to the student. A wheel is usually guaranteed on freight cars for from

4 to 6 years, and for passenger service from 60,000 to 75,000 miles before worn enough to necessitate removal. The iron should be poured as rapidly as possible, a 600 lb wheel being poured in 15 seconds. After the wheel has remained in the flask for 20 minutes it is taken to the annealing pit, where, with some 12 to 20 others the initial heat is supposed to anneal them, being left in the pits from 4 to 6 days. The next process is to measure the circumference by a steel tape, their weight taken, and otherwise inspected. They are now subject to two tests, the drop weight and the thermal (each of which has been often described in these reviews.) In connection with the history of car wheels it seems that the earliest ones date back to 1800. The modern tendency is toward heavier wheels.

STEEL CASTINGS AND THEIR TREATMENT.

The Iron Trade Review, July 10. Mr. W. M. Carr discusses the production of steel castings and their treatment. Attention is always given the proper preparation of the molds and casting therein of the metal, but the final treatment of the finished casting is by no means as good as it should be. Brittleness and coarse grained structure in the casting is the result of imperfect heat treatment, in fact the maximum ductility and toughness of the castings will depend upon this factor more than anything else, with a proper composition to start with.

CAST IRON CAR WHEELS.

The Age of Steel gives the report by a committee of the Master Car Builders' Association in regard to the cast iron car wheel. Considering the discrepancies in weight of wheels used for the 100,000 lb, steel cars, further study is required to see what the development will be in the next year. In view of this the Committee recommends the collection of information, giving the weight of wheels, the capacity of cars, character of breakage of wheels that failed, track circumstances so far as grade is concerned, with full information of use to the Committee in studying the problem.

SNAP FLASK WORK.

The Tradesman, June 15. Mr. E. H. Putnam discusses a variety of things in his article headed "Mechanical Bigotry," and among

these the development of snap flask work is worthy of special attention. The snap flask is one of the most valuable devices ever introduced into the foundry. It requires practice and study on the part of the foundryman to get the utmost value out of it. Formerly the "snap bottom board" was made equal with the outside dimensions of the flask, but now the "squeezer" has cut it down to a size slightly smaller than the inside of the flask. This means a gain of two inches between the molds set upon the floor, a better mutual support, and less "run-outs." The next thing was a reduction of space between the pattern and the sides of the flask, and then where the castings are heavy, bands of steel are placed inside of the flask and are dropped out with the mold, preventing it from spreading when poured. At the present time the molds may be packed closely together, the weights being duly shifted, where the kind of work allows it, and boxes only used where bands will not be a sufficient safeguard. As a rule an inch space may be left around the pattern for the sand wall. The economy of the snap flask method is seen when it is remembered that fifty molders putting up 100 molds each would mean 5000 flasks of the ordinary kind instead of 50 snap flasks.

STARS.

The Tradesman, July 15. Mr. E. H. Putnam enlarges upon the great value of "stars" in the cleaning department of the foundry. There is hardly a corner of a casting into which the long hard points do not penetrate, scratching off every particle of burnt molding and facing sand. Mr. Putnam suggests that founders who have no star patterns purchase say 100 lbs. of them from a malleable iron works, then pick out as many good ones as it is desired to mold up in one flask, say 66 to a 10 " x 15" flask. Ram up a drag on a smooth, level followboard, roll over and imbed the star castings in the joint by pressing them down to the parting line. Ram the cope on this, remove it, draw the patterns, build up the outer part of the joint of the mold to produce ¼ " thickness, and cast. The result will be a metal plate, with half the patterns on the drag side and half on the cope. For the benefit of those molders who desire more detailed information on this point, Mr. Putnam goes into the minutiae of the process in his article.

TEST BARS.

The Ironmonger, June 14. Mr. Robert Buchanan arraigns the test bar in scathing terms, holding that it is in no sense a true indication of the value of the casting it is supposed to represent, a fact which every experimenter in cast iron has come across. He gives tests in which the same iron cast under different conditions gave a variation in strength of 17 per cent. Another case of a coupon test; one strip was almost three times as strong as another. Inasmuch as a bar cast on a casting was always found weakest, while the separate bar was strongest, Mr. Buchanan concludes that the coupon bar is nearest the real strength of the casting. This conclusion may be in accordance with Mr. Buchanan's observations, but is considered too unreliable in this country to base a system of testing castings upon. We rather work on the ground of knowing the metal that goes into the castings and using our best skill to see that it does not have its good qualities sacrificed in the casting.

SPECIFICATIONS FOR FOUNDRY SUPPLIES.

The Iron Trade Review, Sept. 18. The specifications for pig iron, molding sand, etc., used by the J. I. Case Threshing Machine Co, are now very well known. Mr. W. G. Scott, their author, has aimed to get the best class of supplies that can be obtained, and yet under simple and fair requirements. Here are the specifications for foundry iron :

	No. 1.	No. 2.	No. 3.
Silicon, not less than	2.50	1.95	1.35
Sulphur, not over	.03	.04	.05
Phosphorus, not over	.60	.70	.80
Manganese, not over	.50	.70	.90
Total carbon,	Not specified	.10	

Below these figures for silicon, or .005 above for sulphur means rejection. The American Foundrymen's Association standardized drillings are used as "standards," and Mr. Scott gives his method for determining the composition of the iron.

For the coke used the following is specified :

Moisture, not over	1.50
Volatile matter, not over	3.50
Fixed Carbon, not under	86.00
Sulphur, not over	0.75
Ash, not over	11.50

Coke which has over 0.85 per cent. sulphur, .05 phosphorus,

less than 85 per cent. fixed carbon, or less than 5.00 ash will be rejected.

On the sand question the following is given : Silica sand must not run below 95 per cent. in silica, or more than 4 per cent. alumina and 1 per cent. lime. Molding sand is classified according to fineness, and the following limits as to composition are given : Not over 1.50 carbonate of lime for iron castings and 2.25 per cent. for brass work, similarly not over 5.5 per cent. and 7 per cent. of iron respectively. Organic matter not to be over 1 per cent. and alumina not to be over 13 per cent. Core sand should not have over 5 per cent. of alumina and 2.5 per cent. iron. A series of specifications for gray iron castings are also given, and these will be reviewed later, or in connection with other matter in the same line.

PHOSPHORIZING METALS.

The Aluminum World, Mr. E. S. Sperry gives a good method for treating phosphorus intended to be dissolved in a bath of melted metal. It will be remembered that phosphorus is a dangerous thing to handle, on account of its high inflammability. Until used it must be kept under water. To overcome this difficulty the stick phosphorus is copper plated, thus : dissolve one pound blue vitriol (sulphate of copper) in one gallon of cold water. Place the stick phosphorus in this solution and leave it long enough to secure a good thick coating, moving the sticks about from time to time to get every portion covered with the copper precipitate. Before using leave the plated sticks in the air for half an hour to dry thoroughly. Insert into the melted metal by either tongs or a plumbago phosphorizer. As the amount of phosphorus actually getting into the metal is somewhat uncertain it is better to make a rich phosphor-bronze alloy in the first place, determine the phosphorus in it, and add to the required metal in the proper amount.

TO PREVENT "RAT TAILS."

Iron Molders' Journal gives a molder's remedy for these unsightly blemishes in the product of the stove foundry. Where work is "returned" use cement between the heavy and the light facing; that is, first heavy facing, then cement, and then the light facing. Where no facing is used at all use one shovel full of slacked lime to 16

shovels full of sand, mix well and run through a fine riddle and use just enough of it to cover the face of the plates. If non-effective use more lime. It will do the work.

A METALLURGICAL PROBLEM.

The Tradesman, Feb. 8. Mr. E. H. Putnam came across a remarkable series of occurrences in his foundry in making small castings, such as fittings, etc. The illustration possibly shows it best, as the photo-engraving was made directly from the castings at the time.

The white spots are very peculiar, being in a measure partly surrounded by gray material. These white spots were not in all the castings, but in so many that there must have been some potent reason for their existence. The analysis of the white and the gray portions is as follows (two separate samples):

	White	Gray	White	Gray
Combined carbon	3.35	1.35	3.25	1.20
Graphite,	.26	2.32	.19	1.90
Silicon,	2.55	2.36	2.43	2.32
Sulphur,	.139	.143	.137	.137
Phosphorus,	1.057	1.079	1.066	1.100
Manganese,	.26	.27	.24	.25

From the high amount of sulphur present it will be seen that there must have been a tendency to chill from that cause alone, yet the fact that gray portions of the casting often surrounded the white

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entirely made this explanation seem a little doubtful. The phenomenon has been observed by others. Mr. W. Whitney writes that he has often met with it unexpectedly also. He hopes to solve the difficulty by metallographic methods. So far there has been no satisfactory explanation, and the case is given to our members for their information and possible solution.

CUPOLA LININGS.

The Age of Steel, Sept. 20. Mr. Walter J. May writes in the "Mechanical World" on this important subject. The outer ring of brick in the lining is usually laid flat in England, the inner lining from the bottom to the charging door is composed of arch bricks set on end. These arch bricks, however, being hard to get out, it is best to put in two to six plain fire brick courses to pull out readily in repairing. For the tuyere openings Mr. May recommends cast iron blocks extending a half inch inside the lining, claiming that they are not injured during the melt on account of the cold blast passing through them. He also recommends a cast iron ring for the top of the inside lining to protect the brick from injury due to the falling pieces of pig iron. For the binding material of the lining gannister is recommended, which, although dearer, is so much more durable. The lining is supposed to dry for a week, and then a gas coke fire lighted to gradually warm it up. Finally before melting, a layer of gannister of the consistency of putty is to be worked over the lower part of the lining about ½ " thick just over the melting zone, and 1 " thich at the bottom. This protects the brick from the heavy strain of the first melt.

SCABBING.

The Tradesman, May 1. Mr. E. H. Putnam writes of the various causes for scabbing. Mr. Bury had written in the "Foundry" that excessive application of the trowel on the face of the mold had a tendency to disturb the particles of sand, which caused washing off in patches, leaving scabs. Mr. Putnam holds that this effect is there, but more from overslicking, being in reality a hard ramming. The sand is compacted so strongly that steam generated cannot pass off freely, and the result is a displacing of the mold in the line of at least resistance, or inward into the mold cavity. After all hard

ramming is a relative term; what might be too hard over a high projection in the cope might be too soft on the drag side of the same mold. A mold hard rammed all the way through would probably cause a blow. To prevent blowing the gases must be able to flow off freely to a depth sufficient to insure recondensation by contact with the sand at normal temperature. Where the recondensation is inadequate through cores or pockets, proper vents must be provided. In many instances the sand is so close that it naturally causes scabbing, in which case it is well to add sharp sand. Sea coal facing is also efficatious in giving the necessary porosity for the free and harmless flow of the gases.

COMPRESSION OF CAST IRON AND STEEL.

American Maufacturer, May 8. In connection with the designing of parts of the dissappearing gun carriages, it became necessary to make some compression tests on blocks of cast iron and of cast steel. It was found that the elastic compression of the two metals was practically the same, amounting to .0047 in. for cast iron; .0039 for cast steel and .0037 for forged steel, with a load of 400,000 lbs. on a rocker 12 inches wide. The compression extended for about 5 inches into the metal, produced no disintegration or permanent set, in fact the metal returned to a point beyond its original form when the load had been removed. The method by which this peculiar behavior was determined is described at length. The experiments were interesting in that they showed the reliability of the metals when under severe compressive strains.

ARSENIC IN BRASS CASTINGS.

American Machinist, April 10. Mr. E. S. Sperry, of Bridgeport, Conn., describes the value of arsenic additions to brass castings. Where zinc is used the oxidation of the molten metal is so strong that many particles of oxidized products are carried into the casting, being held there when the metals sets. The usual way to prevent this oxidation while pouring is to surround the stream with burning oil, the flame acting as a reducing agent. What is really wanted is a substance which oxidizes when in the air while pouring, which leaves no film on the metal, and which is used in small enough quantities not to affect the alloy. This Mr. Sperry found to be metallic

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arsenic. The amount to be used varies from 0.01 to 0.25 per cent. the latter amount to be used only in extreme cases. For instance, with "bright" brass, containing 63 per cent. copper and 37 per cent. zinc, 0.05 per cent. arsenic is the proper amount to be added.

SAND MOLD FOR STEEL CASTINGS.

American Manufacturer describes the process used by H. B. Atha, of East Orange, N. J., for making molds capable of resisting high temperatures. After the mold is made a wash of the following composition is applied: Five parts of rosin, by bulk, are dissolved in 12 parts of naphta. To one part of this solution add two parts of naptha and 3 parts of carbonate of magnesium. The rosin serves to thicken the liquid sufficiently to hold the carbonate of magnesium in suspension for painting purposes. The carbonate of magnesium enters the pores of the sand, while the liquid goes to the interior of the mold. After painting with the wash, fire is applied, which leaves a hard crust of highly refractory properties in the mold.

STRENGTH OF WHITE CASTINGS UNDER HEAT TREATMENT

The Iron Trade Review, Aug. 21. In a paper read by Mr. A. E. Outerbridge, Jr., before the American Association for Testing Materials, the heat treatment of white iron castings is discussed, the instances cited going to show that it is possible to radically change the nature of such castings without making them truly "malleable" ones. An instance of over-annealing the chilled treads of car wheels is given whereby soft gray spots were produced. The process of annealing castings with a composition of ordinary mallable is now described, the difference, however, being that none of the carbon leaves the metal during the operation. Mr. Outerbridge therefore holds that this makes it quite a distinct metal, while "malleable" men who have done the same thing for years in emergencies think it only one phase of regular annealing work, but too uncertain to make a specialty of.

TREATMENT OF "CHILLS"

The Tradesman, June 15. Mr. E. H. Putnam tells us how to take care of chills and iron cores, so much used in the foundry. For

plow molds coat them with kerosene (carbon oil) after the mold is ready to close. Where very smooth surfaces are not required, any waste oil or grease is good enough. Where however, the chills are to act as iron cores their treatment is much more difficult. Where ample taper is provided for, simple oiling and coating with parting sand will work. Where the taper is only slight a painter's Japan is better, castings being not nearly so apt to blow with Japan. A very fine grade of sand is necessary, coarse varieties leaving unprotected spots.

MOLDING PIPES WITHOUT PATTERNS.

American Machinist, Oct. 2 Mr. F. W. Shaw describes a method of moulding pipes without patterns which allows moulding operations to begin immediately. Only time enough to make the necessary templates, strickles, etc., being required before. He says, "For the purpose of explaining in detail the method, I take, for example, a double-flanged bend or elbow. For this pipe, the patternmaker would make four-flanges, Fig. 1, cut to fit the core, two templets(true semi-circles);one (Fig. 2) the diameter of the core, the other (Fig. 3) the diameter of the pipe. If for a 3-inch pipe the former would be 3 inches diameter, the latter, say, 3¾ inches; one strickle (Fig 4)cut to the size of the core 3 inches in the supposititious case, and one templet (Fig.) 5 exactly the same shape and size as the lengthwise section of the core, *i. e.*, 3 inches wide for a 3-inch pipe, this templet to be about 3 inches longer at each end than the required pipe.

Fig. 6 to 9 show how to proceed with the moulding of the pipe. Prepare a level bed rather larger than the box part to be used, and bed in the core templet, with two half-flanges in position, level with the surface of the bed (see Fig. 9) . Now remove the templet and strickle the sand until the straight side of the strickle is level with the bed.. Fig. 7 shows this operation partly accomplished. Before finishing off this part of the mold it would be well to insert, some distance below the surface —a distance regulated by the length of stock chaplets—a block of wood to form a support for the chaplet. By the neglet of this simple matter, or by placing reliance upon the chaplet simply having its support by the pressure of the sand upon it, much trouble might, and often does, ensue. This block of wood

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FIG. 1

FIG. 2

FIG. 3

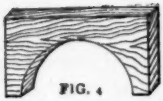


FIG. 4

Templates and Strickles

FIG. 5

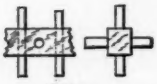


FIG. 10

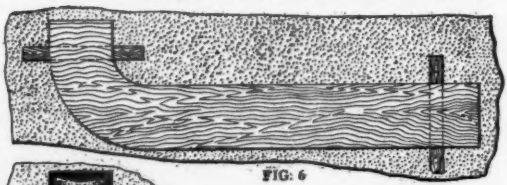


FIG. 6

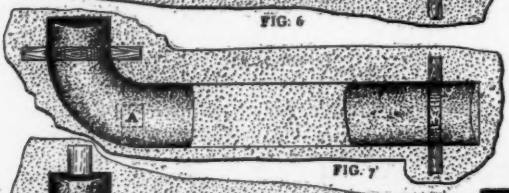


FIG. 7

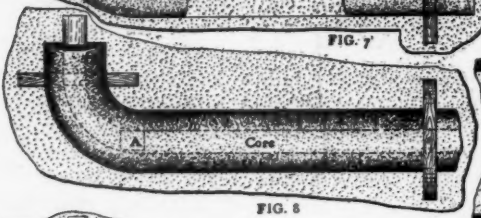
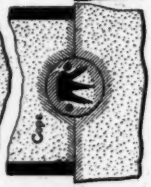


FIG. 8



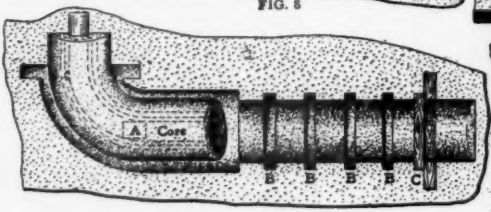
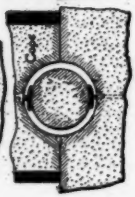


FIG. 9



MOLDING PIPE WITHOUT PATTERNS.

can afterward be located by pressing in a vent wire and feeling for it Fill up the groove strickled out with first a layer of wet parting sand, then facing sand and then floorsand, and bed in it a core iron and ropes to form the vents, which ropes are to be withdrawn after completing the core. I have shown two vents, one of which, however is provided only as a safeguard in the event of one becoming blocked up. In order that there may be no liability to disrupt the core in drawing the ropes, it is better to insert two short ropes for each vent, overlapping where they meet at the bend of the core.

Complete the core, as shown in Fig. 8. piling up the sand and striking it to shape by means of the strickle, Fig. 4, care being taken the while that the top half matches the bottom one. Smooth the core and cover with a thick coat of wet parting sand. Withdraw the venting ropes and plug up the vent holes to prevent them becoming filled with sand while running up the cope. Fix on the other half-flanges and spring them in position. Fix on the cope and ram up as usual. Remove the cope and then the core. Now loosen the sand at intervals along the mold and stamp in the templet, Fig. 3, care being taken that it is stamped in concentric with the mold in which the core was made. At C is shown the templet not removed, and B B are the grooves formed by this templet. Cut away the sand between the grooves, using the templet to insure a correctly joined mold, and similarly in case of the cope. The left-hand half of the sketch shows the core fixed in position on the finished mold resting upon a chaplet A, and the end view is a section of the finished mold with the core in position and covered. The mold will be vented, and runners and gates and risers made in the usual manner.

Although I have shown a flanged bend or elbow, the method is available for pipes of every description, straight, bends V's, Y's, T,s, either flanged or socketed; but in the case of socketed pipes, although not absolutely necessary, it is advisable to have a socket pattern in halves made. The appearance of the pipe of course depends on the dexterity or want of it, as the case may be, of the molder. The core being made in green sand will not be so firm as a dried loam core, and care must be taken to get it by the well—but not too well—using of the trowel."

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MOLDING BOSSES ON CASTINGS.

American Machinist, Aug. 7. Mr. John M. Richardson illustrates a number of ways in which bosses can be put on patterns so that they can be withdrawn from the mold. Fig. 1 shows two bosses on a pattern which is in halves and having the interior cored out forming a shell. The pieces are simply wired on, and, after each half

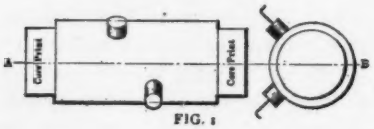

FIG. 1

FIG. 2

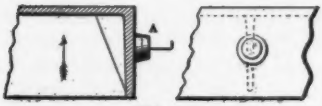

FIG. 3

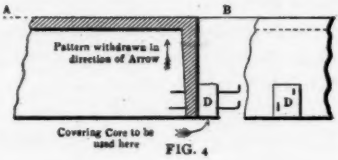

FIG. 4

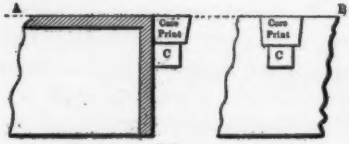

FIG. 5

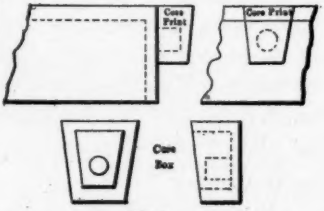

FIG. 6

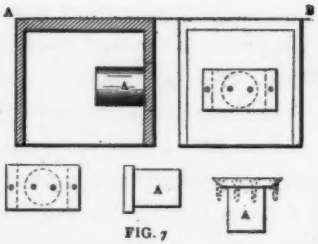

FIG. 7

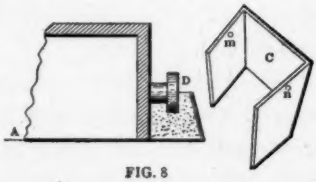

FIG. 8

of the pattern is removed from the mold, the loose pieces are withdrawn. Fig. 2 is supposed to represent a pattern of some considerable depth, with both interior and exterior projections, A and B, where the entire inside is lifted with the cope. The bosses here can be of almost any size and length without causing trouble ; for, when the wires are withdrawn and the cope is lifted A comes with it and is then removed, while B is taken out after the pattern is drawn, coming into the large cavities thus left. Fig. 3 shows a boss attached loosely with a wire, but in two parts. The example taken is more favorable for this method than are the others shown, for the piece to be drawn is tapering on the sides, and there is a rib directly behind it, which leaves plenty of room to insert the draw wire. The body of the pattern is supposed to have a flat cope, and to be drawn out in the direction of the arrow. Fig. 4 shows a case where a pattern has a boss even with the lower edge and a covering core is used. The pattern is placed with the edge AB on a mold board, and is rammed up to the top level of the boss D, which is then removed ; a flat covering core is placed over the cavity and the ramming of the nowel is continued to completion. After this the flask is turned and the cope, which is flat, is made. The entire pattern is in the nowel, and the pattern is drawn in the direction of the arrow. Fig. 5 illustrates one of the commonest methods of managing ears, lugs, etc. by means of a core print reaching from the top of the boss or lug to the parting line of the mold. If the boss was round it would have to reach to the centre, and half of the boss would be made up in the core box. The principle indicated in Fig. 6 also is often employed, having the entire projection formed in the core. In such cases a block core print larger than the boss is attached to the pattern, and the boss itself is placed in the core box, matching the print. The dotted lines shown within the core print in this figure show the position of the hub on the pattern. This way is more commonly used when the boss is either round or of some peculiar shape, and when it seems desirable for some reason to avoid loose pieces. A core is also often used when there are a number of projecting spots just alike in size and distance from the parting line. Fig. 7 shows a case which would not be practical except on a large job. The conditions are that the pattern is of a shell or box character, with walls and a large hub on the inside. The pattern is to be drawn in the same direction as Fig. 4, and placed on the mold board and rammed up in the same

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manner, but no cores of any kind are to be used. A rectangular place is cut out of the wall of the pattern larger than the hub, and beveled on the two ends. A piece is next made to fit this, with its ends beveled to match and held with screws, having the boss fastened to its centre with screws. In ramming the pattern after the hub A has been covered to some depth, the screws are loosened from the outside, and the cover piece with the attached hub is removed. The hub itself is now unscrewed and the cover piece is screwed back in place, when the molding proceeds as though there had been no hub at all. Still another way to manage a projection awkward to mold is shown in Fig. 8. It is by means of an iron draw-back or pocket shown in perspective in C, and placed in position against the pattern at D. The edges next the pattern are beveled to a knife edge, and the top of the drawback comes to the middle of the boss. It is put against the pattern, which stands on the mold board at AB, and is filled with sand first; then the entire outside of pattern, and pocket or drawback as well, is rammed up, and when the flask is turned and the copies made and lifted the pattern can be capped and the pocket drawn first, which gives ample space to clear the boss, when the body of pattern is next withdrawn. Two small holes in the edge of the pocket at mm provide a means for lifting it.

COMBINATION IRON FLASKS.

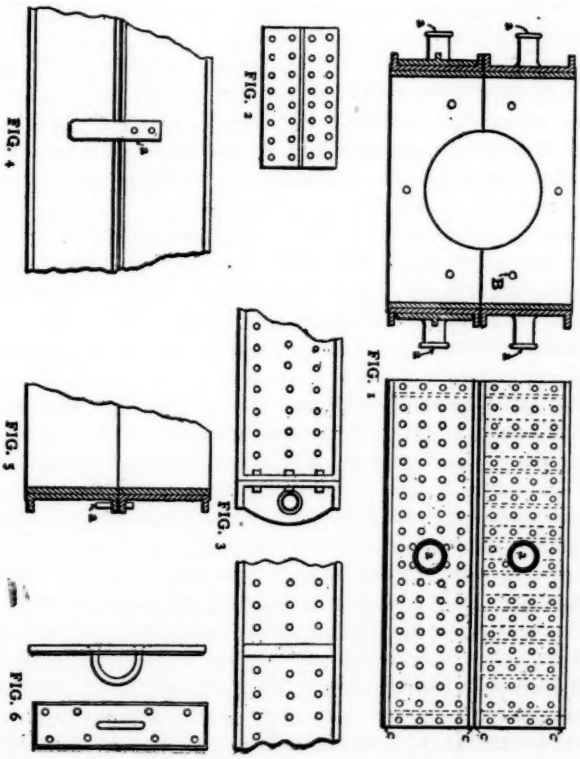
American Machinist, Aug. 7. Mr. R. H. Palmer illustrates his method of building up iron flasks in such a way that they can be easily altered.

Fig. 1 shows an iron flask bolted together at the corners, the sides some 5/8 inch thick, with flanges or ribs on each of the sides; these ribs are set back from the edge about 1/8 inch, while there are four rows of holes and trunnions. The ends are plain, with flanges at each of their ends to bolt the sides against. The holes in the sides not used for bolt holes to fasten in bars, form vent holes, and by having them in lines the bars may be placed to meet the pattern as required.

It will be seen that the end is left with a large, round opening, as there have been pipes made in it. Bolt holes B also are seen; should occasion require, a plate made in open sand with holes in it can be cast and bolted against the ends of each half to close the hole. The flask sides were drilled for pin holes in the ribs C, so that one may

place one half on top of a cope and make a three-parted flask, or as many parts as he wishes; then the holes often come handy for bars in a cheek. In leaving the rib back from the edge a fraction of an inch it forms a chipping piece around the edge so that it can be easily chipped to fit together in case there is any rocking of the part on another. The bars in the cope are cast with a part of the circle cut out for pipe; by coring a few holes in this bars, chucks are easily bolted in as required. As these holes are ½ inch, a number of spikes easily fill them and a wooden bar can be fastened in.

Fig. 2 shows a piece cast with holes to match those in the side of



the flask. If a flask is required longer, take out the end of one, butt it against a second, and use piece, Fig. 2, to tighten together, take short bolts out of the brass and use longer.

In making flasks which are wanted to be, say, 18 or 24 inches deep, instead of making the nowel or drag the full depth required, divide the depth in at least two or three sections. I have many times found it better in making a flask where a deep nowel was required to make it in sections, say, 8 or 9 inches in depth, or 8 and 12 inches, having holes bored so that when it was through with the job it was made for, if occasion required, the bolts holding it together could be removed and the same holes used as pin holes. Bars of the required shape were cast, and a shallow flask was the result.

In every jobbing foundry there is a certain run of work that seems natural to that foundry and that requires flasks of certain sizes, but varying principally in depth. A flask may be quite long and perhaps of slender build apparently, yet easily handled if arrangements are made to hitch on to it so as to properly balance it when hoisting with a crane.

In casting trunnions on a flask I have them made in a core, and set the core where I wish a trunnion, and ram it up in the mold.

On the larger flasks of iron an arrangement, Fig. 3, combining a staple to hitch into when rolling over a heavy cope, may be found very useful. In making it a rib is added on the pattern extra heavy with a core print.

Flasks of different lengths and width of the above style will be found very convenient. We have them from 30x36 inches up, and in the style of flask I have shown. If a smaller flask is required for green sand, drop a piece of board in the ends to close up.

In regard to pins for iron flasks, a foundry usually finds them quite expensive, even if a machine shop is a part of the concern. I have tried coring some holes in the side of the cope and casting a cast-iron guide A, Fig. 4, and bolting it to the cope. If one is broken it is easily replaced. I like cast iron better than wrought, which gets bent unless very heavy. If cast iron is used and gets broken (which I have not had happen), throw it among the bad castings and replace it.

Another style of pin is shown in Fig. 5. The same sized hole is bored in the cope and nowel flanges. The pin is tapered but very

little for three-quarters of its length, and near the smaller end it is tapered more. The larger end is simply too large to drop through the hole. I find the pin works very nicely and is very cheap. I had one turned out of wood and gave it to the molder, who cast it on end. We rattle them and they are ready for use.

Now, if in the flask where we use these pins we are making a casting requiring a long steady pin, we have a set of long pins made of common round iron, with one end an inch or two bent square over and the other drawn out a little, but not to a sharp point. We drop these pins through the holes in the top flange of the cope, passing down through the hole directly under in the lower flange of the cope and through the hole in the top flange of the nowel, and we have them as long as we wish. In some flasks we use ⅝-inch round and some ¾-inch, the holes being bored large enough for the round iron to pass through easily.

In making iron flasks they can be made quite light if well ribbed on the sides, but there is a limit either way. One often sees castings strained because the flask is not stiff enough to withstand the side strain, and the man making it does not realize the amount of strain on his flask and does not provide side binders, or top and bottom binders when there are lifting strains.

In providing for the handling of large flasks, I have been in the habit of casting a piece of casting like Fig. 6, making them of different lengths and sizes so that they could be changed from one flask to another, and bolted on to the sides of cope and nowel. In hooking into them and rolling over a large cope, it is better to wedge or block around the hook, but the size of the staple is regulated by the sizes of hooks on chains. Often a piece of rag wound around the staple will do the business, but the safest way is never too safe. I have the staple upset on the ends, have a rough pattern made the size I wish, burn out the holes for bolts with an iron, also the holes for the staple, set the staple in the pattern and mold. I had some cast with the staple just nicked, instead of upset, to keep from pulling out, but as the nicking was done too deeply the staple broke out and it came near being a bad accident while rolling over ; so I had rather have them upset.

In general, where light crane flasks are used, iron ends will be found very servicable. Once in a while you will find a molder who will not look at his cope to see if the bolts are tight, and who will

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cuss the flask because he did not and because the flask cannot keep itself in order, but he is usually one of those men who find everyone to blame for their own carelessness, not themselves.

Considerable changing about can be done with iron ends as well as wooden. I have a flask in the foundry in use by one of the molders which was made from an old lathe-bed flask some 6 inches thick. It is fastened together by bolts extending from side to side outside the ends. The cheek was originally altered to some 6 feet 6 inches square by 25 inches deep and a tank was swept up in green sand in it, some 5 feet 10 inches in diameter by 25 inches deep. It was then unbolted and packed away. Later the sides were used, ends were put in and a pipe 15 inches in diameter was swept; this part was barred up for a cope for it. It has now been taken apart again, the ends as used for the tank have been replaced, and a ring is made in it some 7 or 8 inches in width, 12 inches deep on the inside and 8 inches on the outside, a green-sand core rising between the two, but the two are connected with plates on top of the core. Meanwhile the bolts did duty as binder bolts. I have some flasks made in the same way where the ends are not gained into the sides, simply butted against them, and where the ends have been moved back and forth according to the size of piece to be cast.

THE CUPOLA BREAST.

The Tradesman, April 1. Mr. E. H. Putnam holds the making of the cupola breast one of the most important points in cupola management. This can be readily understood when it is remembered that all the iron must pass through it.

Having formed the floor or bottom part of the breast, of uniform level with the sand bottom inside the cupola, and three-fourths of an inch higher than the lining of the center of the spout, take a mixture of one-half sharp sand and one-half fire clay, wetted to the right consistency, and wrap it around the smooth, slightly tapered iron bar with which you are to form the tap hole, and lay the forming bar thus surrounded with the coating of fire clay into the groove-scooped out from the middle of the floor of the breast, press it down till the bottom of the bar shall be three-fourths of an inch over the center of the spout, push it hard against the coke wall, throw in new molding sand and ram it in hard.

Take a molder's tool and form the front straight up and down. Withdraw the forming bar, and leave the edge of the tap hole flush with the front of the breast. Blackwash with plumbago in water. The blackwashing is important. True, there are many foundries where it is not practiced; and they get along tolerably without it some of them very well indeed. But the spatterings of molten iron cling with great tenacity to the hard fire clay and molding sand breast, making it difficult to keep it clean and intact. The breast ought to be in as good condition at the finish of the heat as at the start, and the blackwashing is a great aid to that end. With it, the iron can be readily removed from about the tap hole without crumbling or chipping away any of the sand from the breast, at the first few taps, and by that time the sand around the tap hole will become baked so hard that there will be no danger of damage from reasonable careful use of the tapping bar.

The spout, whether short or long, always should be well coated with plumbago wash. This will enable the removal of the solidified iron that may accumulate after putting on the blast and before the first stopping. If a refractory wash is not used, the iron is apt to cling so fast as to cause danger of seriously disarranging the lining of the spout, when it is removed.

Mr. Putnam again calls attention to the necessity of having the bottom of the tap hole ¾" above the bottom of the breast, as a tap hole thus constructed can be more easily cleaned out when obstructions have formed. Another point is to have the bottom and side of the spout lined with fire brick, as this allows some hard chipping to be done. The front of the tap hole should not be reamed out like a pouring gate, as otherwise the stopper will wedge itself too firmly. The stopping material is best made of one half fire clay, and one half molding sand, or varying proportions of each material. Fire clay alone is too strong, and molding sand mixed with flour, which is often used, is inferior.

LABOR SAVING MACHINERY FOR THE FOUNDRY.

Cassier's Magazine Nov. 1902. In an illustrated article on the above subject Dr. Richard Moldenke states that it is in foundries where thousands of castings of a kind are made that we find modern conditions aimed at. In the industrial war between nations, now becoming more and more acute, this will count heavily, for now that

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inventive genius has been directed into the foundry channels, we find British, German, and American trade journals full of suggested improvements, as well as actual accomplishments in the line of rapid and cheap production of castings. To save one labourer the year around it pays to invest about $2000. How many labourers will one find about a foundry of some size who could be thus profitably dispensed with?

The various appliances about the power plant of a foundry which help cut down the running expenses need not be mentioned here. Any modern plant equipped with coal and ash handling machinery, or a gas engine plant with electrical transmission of power, will illustrate the point.

The core ovens may be provided with many an appliance which will facilitate the quick observation of the material within, allow a shelf-full to be withdrawn, without interfering with the continuity of the heat, and be so provided with flues and dampers that the temperature within may be sufficient to thoroughly dry, and yet be perfectly uniform too.

The cleaning facilities of the modern foundry have been augmented by the sandblast. British and Continental practice has been ahead of American in this respect for some time, many shops in Great Britain, Germany and Switzerland using this method of cleaning almost exclusively. Americans rather object to the too excellent cleaning of the castings. Too much poor moulding is shown up by it. On the other hand, the introduction of the sand blast has been a boon to the enameling industry, for the surface of a casting is left perfectly clean and especially free from graphite. The introduction of hydrofluoric acid for picking purposes is also a decided advance, the sand on the casting being dissolved, and not the iron under the scale, as when sulphuric acid is used.

Iron interchangeable flasks, core machines for making the round stock cores now seldom provided for by making special core boxes, moulding appliances which makes use of sweeps, and core appliances working on the same principle are only some of the many devices which help to make up a goodly sum total of money saved during the year.

It is the aim of every foundry foreman to get up useful contrivances in connection with the jobs he has in hand, and these soon become part of the institution. In going through the various foundries one

often sees a device for saving labour and insuring accuracy which commends itself at once. Given the larger appliances furnished by the establishment, these useful kinks frequently double their value.

To-day, more than at any time, the cry is for increased production at lower costs, and well-devised shop-cost systems in the office soon show where a modern foundry appliance is wanted. The engineer has placed at the disposal of the foundry-man labour-saving appliances which can find application in every part of his establishment, and his will be the fault if advantage is not taken of them.

GAS AND OIL FOR MELTING BRASS.

The Foundry. Quite a discussion relative to the use of oil and gas as the fuel in the brass foundry was carried on in several of the recent numbers of this journal. One correspondent found that it shortened the life of the crucibles too much. The makers of crucibles agreed that gas or oil as usually applied was not economical. One of them stated, however, that if used so that the crucibles were protected from the direct flame, and not too much air used their life was as good as when coke was the fuel. Another correspondent had tried a number of oils, but gave it up after noting how the crucibles suffered. The Westinghouse people, who made the most elaborate experiments in this line, got such good results from the use of gas and oil that they put in 20 furnaces of the tilting type equipped for gas and oil, and have doubled the life of their crucibles. An English firm found that to keep their crucibles in the best shape possible it was advisable to keep them hot continuously. They therefore put in an additional row of crucible holes for the crucibles not in actual service. This overcame the breakage due to leaving hot crucibles in contact with cold air.

CASTING ALUMINUM.

The Foundry, March. A few rules for casting aluminium are given by Mr. Harland Tuttle. Use sand as dry as possible. Avoid sponging a mold, better file the casting afterward than lose it. Use large sprues and gates ; cut them into the heavist part of the casting, and usually on top. Pour as rapidly as possible. Do not ram as hard as for iron. Vent all molds well. Pour as cold as possible.

FEEDING CASTINGS.

The Foundry, February. Mr. L. C. Jewett emphazises the fact that one riser, instead of a number of them, will pass more metal and consequently keep open longer. Better feeding conditions therefore result less help is needed, less liability to accident, less chipping afterwards, and less delays in handling the whole operation. The careful molder goes about the feeding process systematically ; he has located the riser where it can be fed easily, has his rods at hand and heated up properly. After casting he pushes the rod down to that it reaches about an inch into the casting, and no more, Feeding is done only a little at the time, so as not to increase the pressure on the mold too much. Moreover, by supplying hot metal often and a little at a time the metal in the riser is kept hot better and the rod remains clean, The result will be a satisfying job and clean mold. In working the rod it should be kept near the outer walls of the feeding head, the center remains liquid without trouble, The time to stop feeding is when the melted metal begins to assume a granular structure. Then it is time to fill up for the last time and after a few minutes loosen the sand around the riser. The job will be done.

GERMAN SILVER.

The Foundry, February. Mr. Percy Longmuir discusses "German silver," an alloy chiefly used in the electrical and table cutlery industries. The best alloy is probably : copper 48 ; nickel 30 ; zinc 22. As this, however, is rather costly, on account of the high nickel contents, other formulæ are used in foundry work. To produce sound castings the copper and nickel are melted in a new crucible under charcoal. When just melted the zinc is added, the contents of the crucible stirred with an iron rod coated with graphite, and when sufficiently liquid, poured into ingots. The ingots are broken up and remelted under charcoal and then "poled" so to speak ; that is, a piece of wood is attached to an iron stick and held at the bottom of the melt, causing it to boil violently, and in this way refining the metal. The crucibles are taken from the fire to do this, and are about three-quarters full. Large castings are best poured by arranging a basin over the gate and inserting a cast iron plug. When the basin is filled the plug is withdrawn and the metal flows through the gate clean. This is really a species of bottom pouring.

While alloys can be made with nickel varying from 30 down to 5 per cent., the following may be recommended: Where expense is no object, and a reliable German silver is wanted, use copper 60; zinc 20; nickel 20. From 5 per cent., to 10 per cent. lead reduces the cost. Iron added in the shape of wire hardens the alloy.

PATTERN METAL.

The Foundry, November. Mr. E. S. Sperry writes about pattern metal in the *Aluminum World*. After going through a number of alloys used in foundries and criticising them he gives the composition of an alloy which is used by a pattern making concern that gets 80 cents a pound for their work as it leaves the sand. Here it is: copper 90 per cent.; tin 6 per cent.; zinc 2 per cent.; lead 1.4 per cent.; nickel 0.6 per cent. This is really a steam metal with a little nickel in it. To duplicate this composition, the nickel being unneeessary, use copper 10 lbs (new); tin ¾ lbs; zinc ¼ lb. and lead 2 oz. For solder use 1 lead and 2 tin, or better still, braze with half and half brazing solder. Mold well in the first place.

CHEMISTRY AND CUPOLA PRACTICE.

The Foundry, October. Dr. Edward Kirk gives some sound advice to the chemist who wishes to succeed in the foundry. He cites many instances where difficulties come from improper melting and where chemistry is of no avail. This is a fact, for the chemist can only start a mixture right; the melter may spoil it afterwards. He therefore advises the chemist to become a practical melter. Dr. Kirk now goes into a number of points connected with melting iron, discussing the melting zone first. This is only 10 to 14 inches high, and the space in which iron is really melted properly is only 6 to 8 inches. It is about 14 inches above the tuyeres when coal is the fuel, and 20 inches when it is coke. When melting the charge of iron the fuel bed is lowered 6 to 8 inches. Enough iron only to do this should therefore constitute the charge. Then must come enough coke to raise the bed from 6 to 8 inches before the next iron melts. It is most important to have a proper bed of coke to begin with. For the single tuyere cupolas about 20 inches of coke above them is about right to have the bed to start with. Then iron three times the weight on this; after this a ratio of 10 to 1 should be held. Experiment will then indicate the best charges, keeping the iron at

a good heat. Under no circumstances use too much fuel in the cupola, as this is just as bad as too little.

DRESSING CASTINGS.

The Foundry, August. Mr. Percy Longmuir holds that castings should present an attractive appearance when shipped, and that this depends upon the treatment in the respective foundry. Apart from defective molding, bad trimming leaves unsightly castings. This is more so in brass than in iron castings. The vise and emery wheel is responsible for many distortions and changes from the round or hexagon forms originally in the casting as it came from the foundry. First of all the dressing up should be done in a properly constructed building equipped with efficient tools. Good benches, vises, and rattlers, but better still, good molding in the first place. For small brass castings the band saw speeded up as high as it will stand it is much better than the gate cutter. For the heavier castings, pneumatic chipping tools expedite the work very materially. Sand blast and picking in either sulphuric or hydrofluoric acid can replace the ordinary tumbling method if so desired.

PLASTER OF PARIS AS A BRASS FOUNDER'S FLUX.

The Foundry, August. While in ordinary brass founding a flux is to be avoided, if anything, yet where emery grindings, washings or buffings are to be remelted, plaster of paris will be found an excellent flux. To use it add four or five pounds to one hundred pounds of the metal, mix well and charge the crucible. When completely melted pour the whole contents into the ingot mold. The slag will rise to the top. Mr. E. L. Sperry, who writes the above mentioned article in the *Aluminum World*, states that the flux can be used over again several times and does not affect the crucible injuriously.

BURNING BRASS ON IRON.

The Foundry, October. Mr. J. F. Buchanan writes of the rather unusual jobs of "burning on" brass instead of iron where a defect was to be remedied. He describes a pump which was in so precarious a condition that burning iron on it would have been a failure. It was filled with sand dried and burned up the usual way, using soft brass. Strange to say it takes less brass or bronze to burn a casting of iron than if iron is used. Naturally the brass must be

"jumping hot". A good composition is copper 16 ; yellow metal 6 ; lead 3; tin 1. Mr. Buchanan finally deprecates the use of fillers and rightly holds that if a job is to be patched up, burning it is more creditable to the foundryman than filling up. He therefore urges that "burning" castings should be studied up carefully by molders and that much work may be saved thereby.

EFFECT OF VARIATION IN CONSTITUENTS OF CAST IRON.

The Foundry, September. Mr. W.G. Scott, the well known chemist of the J. I. Case Company, in an elaborate paper recently read at the convention of the American Society for testing materials, goes into the behavior of the constituents of cast iron, under the various conditions met with, very thoroughly. After describing the methods he uses to insure reliability in his work he discusses the influence of silicon, and finds that it softens iron, imparts fluidity, decreases shrinkage, opens the grain, promotes the formation of graphite, and reduces the strength. Sulphur makes the iron hard, increases the shrinkage, promotes chill, causes the iron to congeal quickly, and gives rise to blow holes, shrinkage cracks and dirty iron. Phosphorus lowers the melting point of iron, imparts fluidity, decreases shrinkage, weakens iron and makes it brittle under shock. Manganese in large percentages hardens iron, increases shrinkage and chill, reduces the bending properties, tending to make the carbon combined. In small amounts it does the opposite of all this by its action on sulphur and the occluded gases. Combined carbon closes up the grain of the iron, increases shrinkage and chill and raises the strength, while graphitic carbon weakens the iron, reduces shrinkage and chill and makes a soft iron. Where specified results are wanted the following pointers are given : To raise the strength increase manganese, reduce silicon and phosphorus. To reduce shrinkage increase silicon and phosphorus and reduce sulphur. To prevent blow holes, reduce sulphur and increase manganese. To prevent kish, increase scrap in mixture or increase manganese.

MOLDS FOR STEEL CASTINGS.

Eisenzeitung, No. 40. To avoid the necessarily slow drying process for the regular steel mold made of silica, clay and coke, Mr. E. Sarg, of Malstatt-Burbach, Germany, proposes the use of ground

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slate from the coal measures. Very smooth castings are said to be the result of using this material the formula for which is as follows: Slate from coal measures, 6; sand 3; coke ½.

CONTINUOUS ANNEALING.

The Iron Trade Review, Oct. 16. At the October meeting of the Foundrymen's Association of Philadelphia, Mr. J. H. Pepper read a paper on a new kiln for continuous firing, and suggested its use in the malleable industry. The kiln is about 123 ft. long and 24 ft. wide. Firing is done from the sides, the product to be burned or annealed entering at one end on suitable trucks, and coming out at the other. The idea presented is of course admirable, were it possible to carry it out effectively for malleable purposes. To the reviewer it seems doubtful whether the delicacy of the annealing process as required in the malleable industry can ever be attained by this adaptation of the glass house "lear". The heat of our present annealing ovens are far from uniform, which results in much trouble from under and over annealing. Again the rolling mechanism would necessarily be under the extreme heat influence, which means a short life. Finally the time required to anneal castings properly would mean a very long oven, the cost of which might be out of proportion to the results expected from it.

COST KEEPING IN AN OHIO JOBBING FOUNDRY.

The Iron Trade Review, Sept. 4th., gives a series of blanks in use in a foundry in which a variety of work is constantly going on. Fig. 1 gives the sheet used for the daily time report. Fig. 2 the daily summary of labor, in which columns are left for men's numbers, rate and hours. Then the molding, cores, direct labor and cleaning. Fig. 4 has the weekly list of material used such as sand, blacking, facing, flour and molasses, with spaces for each day of the week. Fig. 3 gives the summary of work in the melting and drying departments. Fig. 5 the melting and core oven cost for the month. Fig. 6 gives the cost sheet of the month and so arranged that this month, last month, to date, and last year is shown. Averages and totals give a ready oversight in the matter. Finally Fig. 7 gives a general charge sheet for the month. Office expenses, sundry expenses, cranes, cupolas, shop, etc., are all included here.

SPECIFICATIONS FOR CAST IRON PROJECTILES.

The Iron Trade Review, Oct. 16th. The specifications for cast iron projectiles has been amended recently by the Ordnance Department of the Army. The castings must be made base down for shell, and point down for solid shot, with a sufficient riser to insure soundness and density. 27,000 lbs. per sq. inch is required for sea cost projectiles, 25,000 for siege, 22,000 for field, and 18,000 for mountain projectiles. Specimens are to be taken from cylinders cast at the same time as the projectiles, two from each heat being ordinarily sufficient. Cracks, flaws, sand holes, etc. more than 2-10" deep will cause rejection. Spongy metal likewise. Steam or water pressure is applied finally at 100 lbs. per sq. inch for two minutes, leaky projectiles being rejected. The base plugs of shells to be of forged steel, of not less than 30,000 lbs. per sq. inch in tenacity.

COKE.

The Iron Trade Review, Nov. 6. In a paper read before the Pittsburgh Foundrymen's Association, Mr. N. P. Hyndman reviews the process of manufacturing coke. The serious condition of the coke market attracts special attention to this commodity just now. The distribution of the producing capacity is first reviewed. Then the claim that only in the Connelsville region could the proper coke be made is taken up, and it is shown that the drift mine producer sells his coke in the same market at all times. While formerly coke was wanted with the sulphur below .75, now 1 per cent. is taken without question. Much of the objection to poor looking coke is due to the "black tops," which after all are only signs of too quick coking in the oven. Black tops are not objectionable, but "black butts" are, as these are uncoked coal, due to damp bottoms in the ovens, etc. The 72 hour coke, which is burnt longer, is harder and better adapted for foundry work. Mr. Hyndman now describes the process of burning coke, and Mr. Stroh then discussed the question of coke as used in the foundry. He suggests care in proportioning the amount of blast to the coke used, that the quality be constantly watched and poor material rejected.

COST SYSTEM FOR FOUNDRY.

The Iron Trade Review, Oct. 2, gives the system in use at the United Engineers & Foundry Co's various shops, for keeping costs.

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The card system is used wherever possible. Figs. 1 and 2 give the shop order card, both sides being filled up with data relating to the order. Fig. 3 shows the list of material for mill, office and contracting department. Fig. 4 is for the benefit of the foundry foreman, giving the data relating to the various heats. Fig. 5 shows the daily reports from the foundry. Fig. 6 further elaborates this by giving the product and consumptions of cupolas and furnaces. Fig. 7 is the delivery slip used by the shipping department of the foundry. Next come the slips in use for the machine shop. The whole makes a very complete series of cost records, and should be very valuable in the shops in question.

CAST IRON FOR SUPERHEATERS.

Baumaterialienkunde, No. 12. The Secretary of Commerce of Prussia recently requested the National Engineering Societies of Germany to express their opinion on the use of cast iron for the parts of boiler superheaters. The result of this inquiry was that "the data available at the present time show that there is nothing to prevent the use of cast iron for such purposes, provided the material is of the proper quality for the purpose." The Secretary of Commerce then requested the engineering bodies to recommend the qualities which cast iron should have to be used for superheaters, and the German Engineering Society is asking boiler makers and others for data on this point, for future publication.

STANDARD SPECIFICATIONS FOR CAST IRON PIPE.

The Engineering Record, Sept. 13. The New England Water Works Association recently adopted a set of specifications for cast iron pipe by unanimous vote. This goes to show that there is a very strong desire to standardize everything which is made in sufficient quantity to warrant such a proceeding. There are 20 sections to these specifications, and the ground is covered fully and admirably. Section 9 gives the method of testing the iron. This is by 26 inch bars 2 " x 1 " tested transversely flatwise on supports 24 inches apart. For 12 " diameter pipes or less these bars should support 1900 lbs. and deflect 0.30 ". For larger sizes than 12 inch pipe 2,000 lbs is demanded, with a deflection of not less than 0.32 ". The average of three bars may be taken, and provisions are made for tests on bars other than the size given.